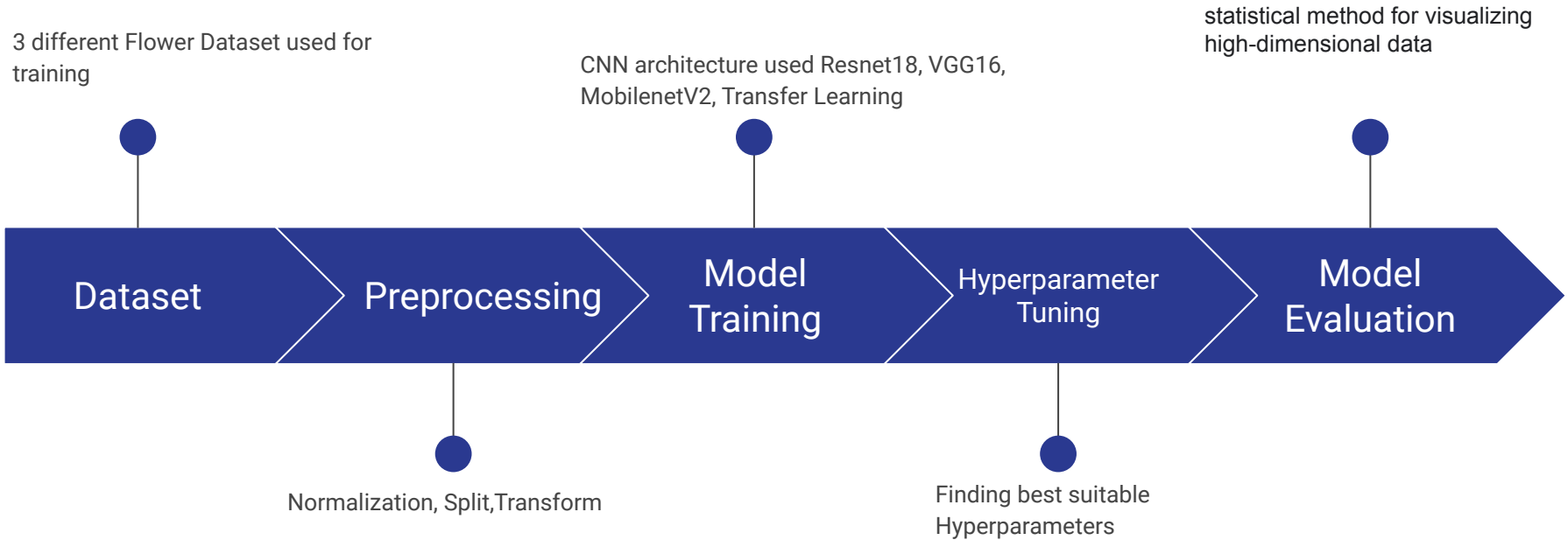
Flower Species Classification

Group P

Sharanyu Pillai - 40227794
Shrawan Sai Malyala - 40236492
Visnunathan Chidambaranathan - 40230157
Ashu Kumar - 40221569

Overview

Identifying different flower species is challenging due to the sheer number of variations within a single species. Accurate flower classification systems can aid in understanding and monitoring the diversity of flower species



The Datasets

Dataset 1

Dataset-1 has 7 evenly balanced classes with 1600 images per class (11200 total images). However, we pruned the number of classes to 5 making the total images to **8000**(to maintain a diverse number of classes

Dataset 2

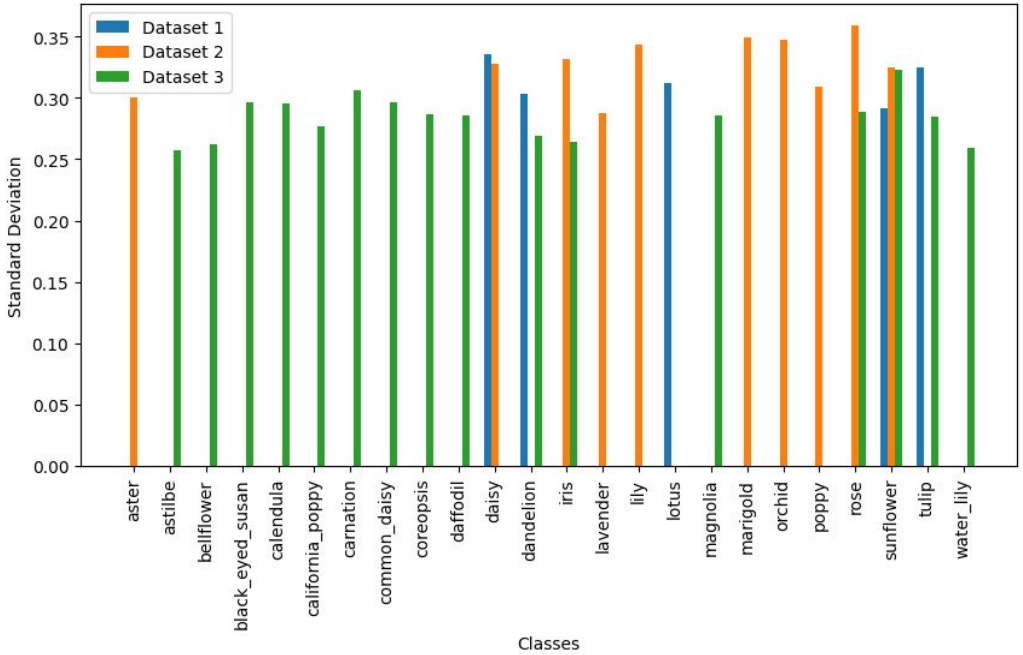
Dataset-2 has 10 evenly distributed classes with 1500 images per class (**15000** total images). A balanced dataset, didn't require manual pruning or trimming.

Dataset 3

Dataset-3 has 16 classes unevenly distributed with a total of **15,740** images. There are 980 images on average per class in Dataset-3 where the number of images per class fell in the range of 737-1054.

Dataset Type	No. of Images	Image Dimension	No. of Classes	Formats available	Avg File Size	Avg Standard Deviation
Dataset1	8k	450x380	5	.jpg: 7463 .jpeg: 234 .png: 303	~ 63 kb	67.4
Dataset2	15k	240x215	10	.jpeg: 14996 .png: 4	~ 10 kb	64.2
Dataset3	15.7k	290x280	16	.jpg: 15740	~ 15 kb	64.14

Data Preprocessing



Normalization

Derive code for finding mean and standard deviation values for Flower datasets and then normalize all images based on those values.

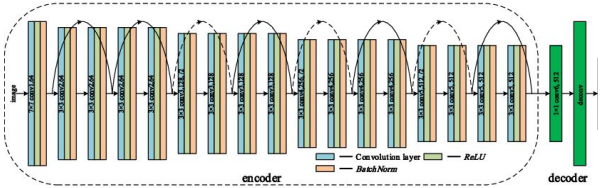
Data Augmentation

Resizing, Cropping, Rotating, Converting and Flip to all 3 datasets

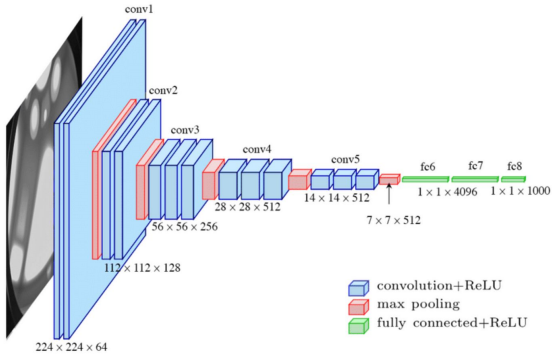
Split

Divide datasets of Flower into 3 parts:
Train – 70%, Validate – 10%, Test – 20%

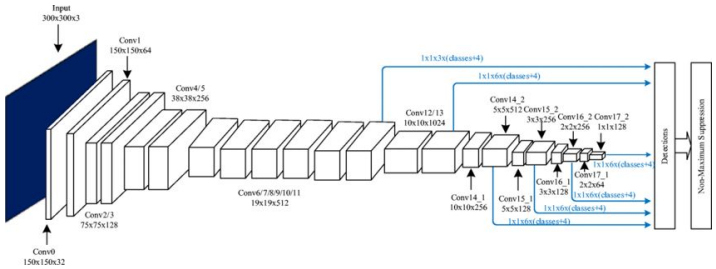
CNN Architecture



VGG 16	Resnet 18	Mobilenet V2
Dataset 1,2,3	Dataset 1,2,3	Dataset 1,2,3



Transfer Learning
Dataset 3



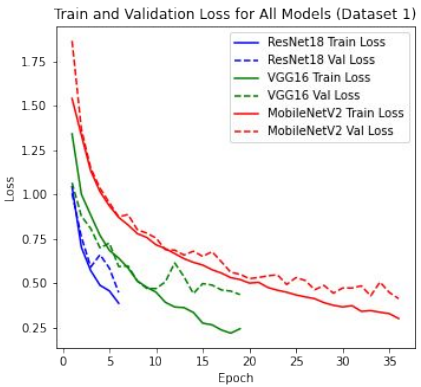
Results

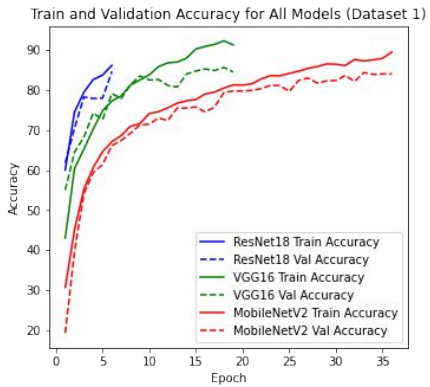
Model	Dataset	F1 score	Recall	Precision	Accuracy
Resnet18	1	83.91	83.81	84.01	83.81
VGG16	1	83.91	83.77	84.05	83.75
MobileNetV2	1	82.97	82.89	83.05	82.88
Resnet18	2	77.18	77.15	77.21	77.11
VGG16	2	72.49	73.26	71.74	72.7
MobileNetV2	2	68.61	69.22	68.02	68.2
Resnet18	3	89.16	88.94	89.37	88.98
VGG16	3	69.11	68.46	69.77	69
MobileNetV2	3	77.13	76.83	77.44	77.54

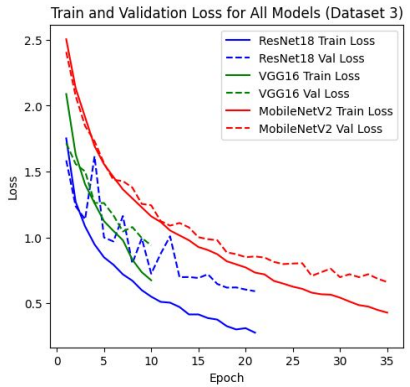
Transfer Learning VS Default Model

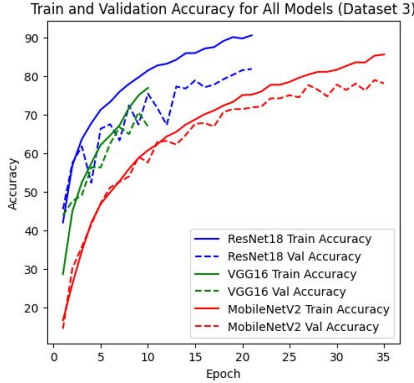
Model	F1 score	Recall	Precision	Accuracy
Resnet18	89.16	88.94	89.37	88.98
Resnet18-TransferLearning	94.68	94.62	94.73	94.73
VGG16	69.11	68.46	69.77	69
VGG16-TransferLearning	93.61	93.56	93.65	93.61
MobileNetV2	77.13	76.83	77.44	77.54
MobileNetV2-TransferLearning	95.93	95.89	95.96	96.06

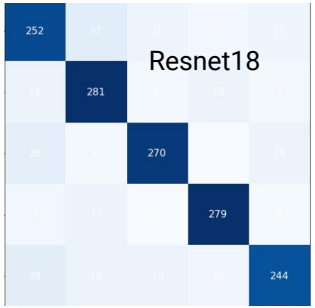
Model Performance across datasets



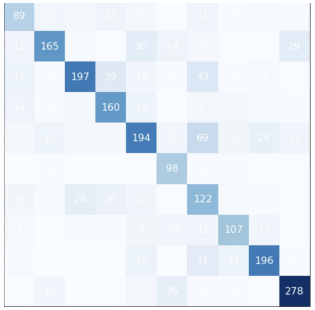




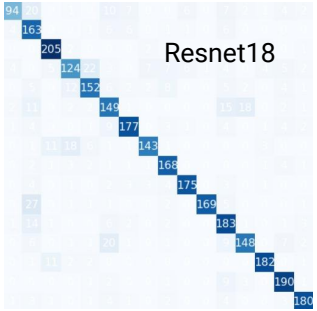




Dataset 1

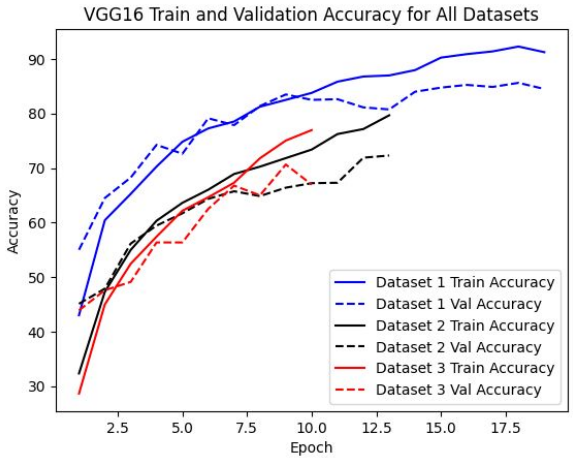


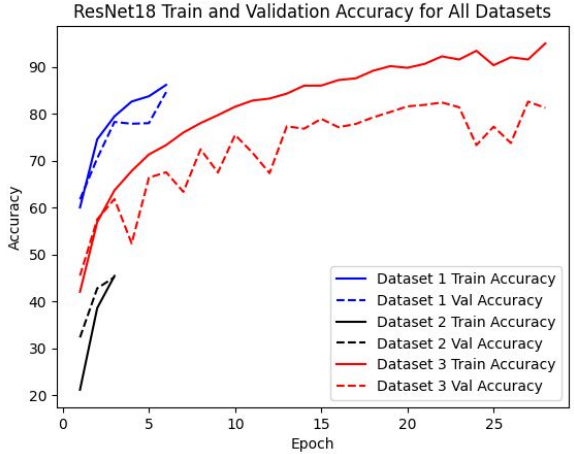
Dataset 2

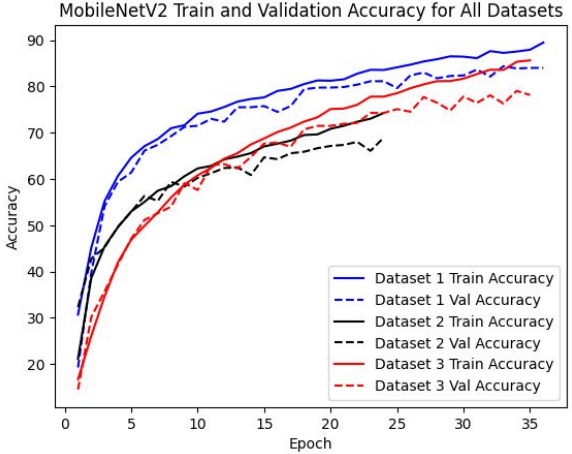


Dataset 3

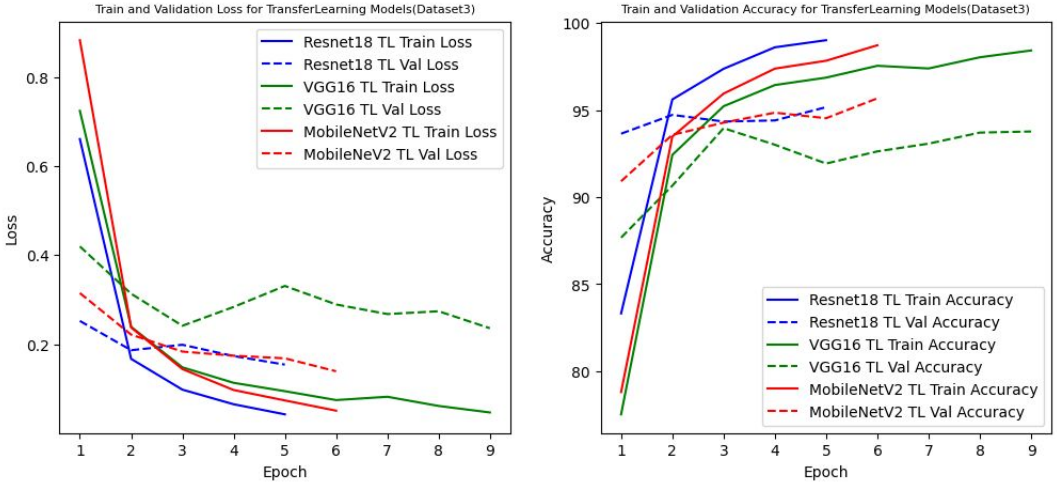
Dataset Performance across all models



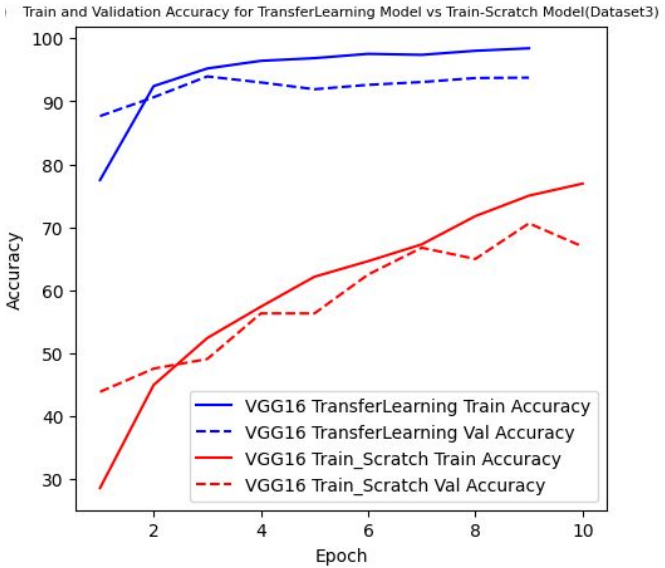




Transfer Learning

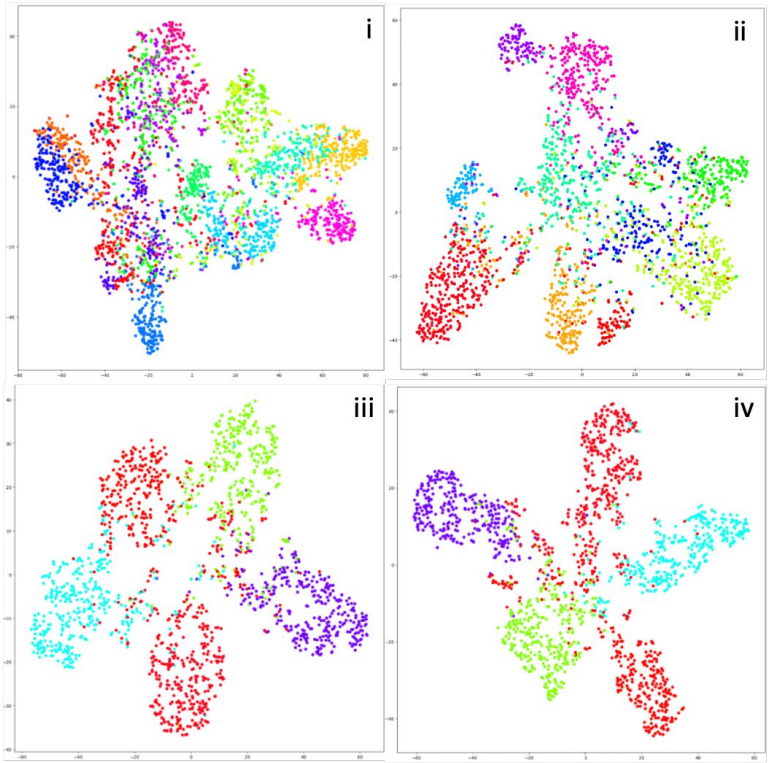


Transfer Learning Results



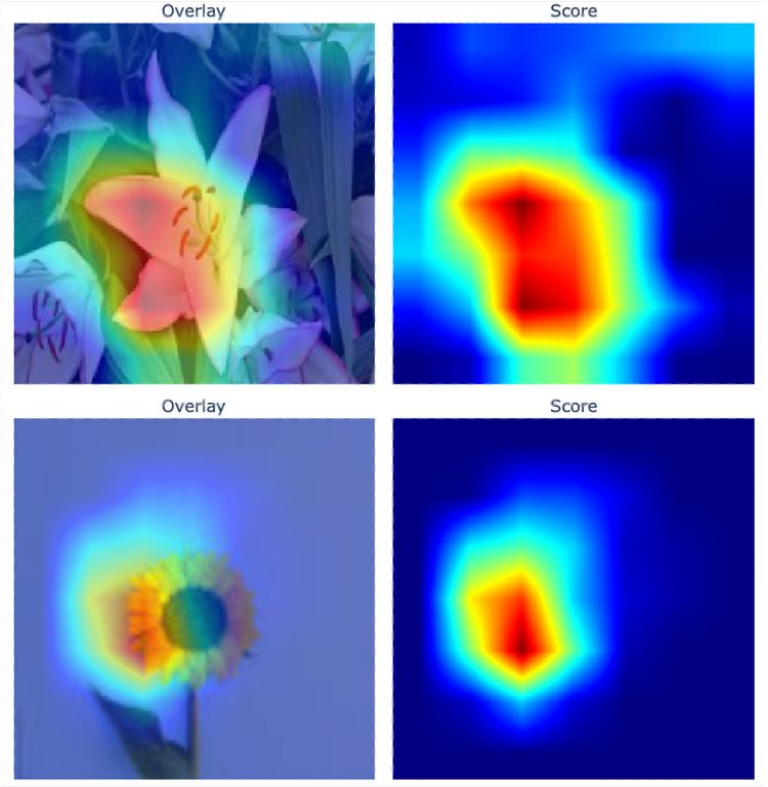
Performance Comparison With & without Transfer Learning (VGG16)

t-SNE & Gradcam



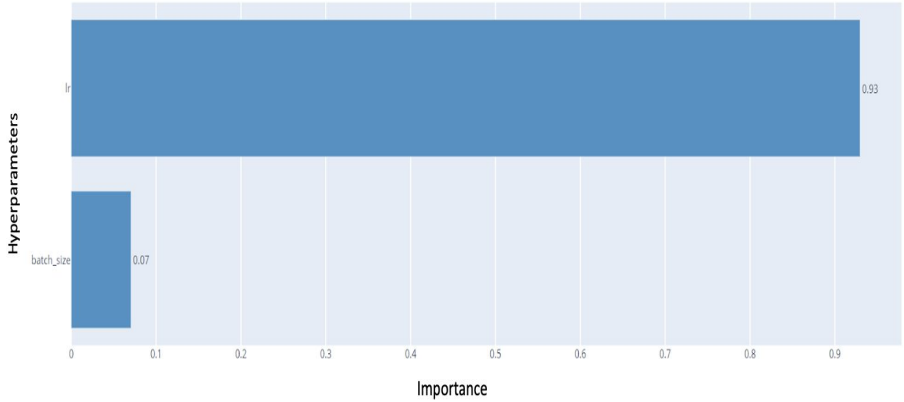
(t-SNE)

i)VGG16-D3 ii)Resnet18-D2 iii)MobileNetV2-D1 iv)VGG16-

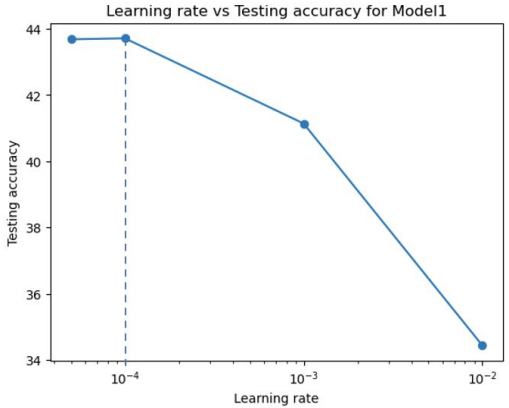


Gradcam

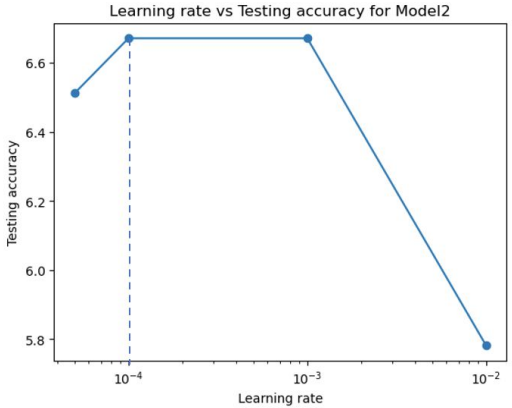
Optimization & Hyperparameter Tuning



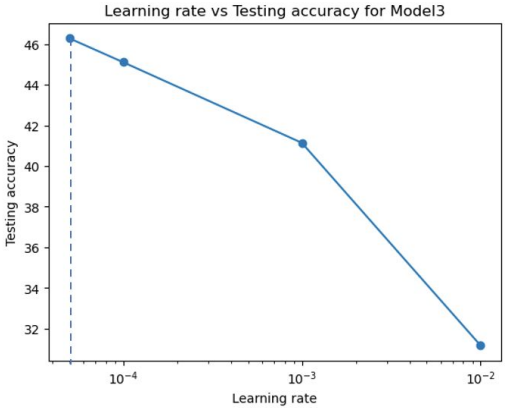
Batch size - 128
Learning rates - 0.01, 0.001, 0.0001, 0.00005



Resnet18



VGG16



Mobilenet V2

Performance

References

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